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BRIEF NOTE

Seasonal and Developmental Changes in Fat Deposition in the Silverjaw Minnow *Ericymba buccata Cope*[1]

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Previous studies on the biology of the silverjaw minnow describe its growth and feeding in Otter Creek, Vigo Co., Indiana (Wallace 1971, 1976). The present study in the same stream investigated the relation between its growth, feeding, and fat deposition and completes the series of studies on this species, including those dealing with its ecology (Wallace 1972), reproduction (Wallace 1973a) and its distribution and dispersal (Wallace 1973b).

METHODS

A preliminary study of 70 adults, 10 per month, collected from March to September, provided information from which levels of fat deposition were established (Table 1 and Fig. 1).

The level of fat deposition was noted in 976 *Ericymba* collected throughout the year in the same areas of Otter Creek as used for previous studies of the biology of this species. Except for February, when too few specimens were available, every month was included. These data were analyzed by season for three different size groups, according to standard length: young (to 29.5 mm); small adults (30 to 39.5 mm); and larger adults (40+ mm). The hypothesis that there was no difference between the size groups with respect to levels of fat deposition was tested with the Chi-square test in an $r \times 2$ table.

RESULTS AND DISCUSSION

In the spring there was no difference between size groups with regard to the levels of fat deposition

TABLE 1

Descriptions of designated levels of fat surrounding the digestive tract in Ericymba buccata.*

Designated Level	Description
0	No fat observed between the first and second intestinal loops
1	Fat apparent through most of the length of contact between the first and second loops
2	Same as level 1 with fat also along most of the length of contact between the stomach and first intestinal loop
3	As above and with fat surrounding at least the posterior of the second intestinal loop. Entire length of contact between stomach and first intestinal loop with fat
4	As above and with fat occurring along the outside edge of the stomach — stomach not entirely covered with fat
5	As above but with stomach entirely covered with fat

*The intervals between these levels are not necessarily equal in time or volume.

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(Table 2). However, in summer and especially autumn, larger size groups had higher levels of fat deposition. In autumn the proportion of each size group with fat deposition above level two was greater than for any other season. In winter a greater proportion of young than large adults had higher levels of fat. The difference between young and large adults was significant ($x^2 = 9.4609$, df 3). The trend toward increase in fat deposition in large adults from May to September is shown in Table 3.

The lower winter fat levels in all size groups are probably accounted for largely by less active feeding during that season as found for this species by Wallace (1976) from specimens taken at the same time in this same study area. Fat deposited in the autumn probably provides a reserve during this low feeding period. The relatively low spring and summer fat levels occur because of increased metabolic rates and utilization of energy for protein assimilation, growth, and gonadal maturation. Spawning occured from May through July (Wallace 1973a), and Wallace (1971) found that maximum growth of adults in this stream occurs between June and July. De Vlaming (1975) demonstrated with *Notemigonus crysoleucas* that reduction in fat reserves is associated with final gonadal maturation.

The later autumnal onset of fat deposition in young fish (vs. small and large adults) is closely related to the rapid growth rates observed in young fish in the spring coupled with the protracted growth period for young fish in this stream which extends into September (Wallace 1971). The higher fat levels in older fish compared to young fish in the summer and autumn is probably a result of reduced growth, physical activity, and metabolic rate with age as suggested by Phillips et al. (1960) in their study of the brook trout.

LITERATURE CITED

de Vlaming, L. 1975 Effects of photophenol, temperature regimes and pinealectomy on body fat reserves in the golden shiner, *Notemigonus crysoleucas*. Fishery Bull. 73: 766-776.

Phillips, A. M., Jr., D. L. Livingston and R. F. Dumas 1960 Effects of starvation and feeding on the chemical composition of brook trout. Prog. Fish Cult. 22: 147-154.

Wallace, D. C. 1971 The age and growth of the silverjaw minnow, *Ericymba buccata* Cope. Amer. Midl. Nat. 86: 116-127.

TABLE 2

Seasonal change in the level of fat deposition in three size groups of Ericymba.*

Season	Size Group	N	Percentage of Individuals with Designated Fat Level						X^2	df
			0	1	2	3	4	5		
Spring	Young	31	45.2	41.9	12.9	0	0	0	0.1615^{ns}	2
	Small adults	42	40.5	45.2	14.3	0	0	0	4.3775^{ns}	3
	Large Adults	151	56.3	33.8	8.6	1.3	0	0		
Summer	Young	60	96.7	3.3	0	0	0	0	26.6193^{**}	4
	Small adults	127	60.6	22.0	11.8	2.4	3.2	0	8.0004^{ns}	4
	Large adults	204	52.0	21.6	13.2	10.3	2.9	0		
Autumn	Young	80	28.8	47.5	11.3	12.5	0	0	$14.4450^{\dagger}$	5
	Small adults	71	19.7	36.6	22.5	9.9	9.9	1.4	27.2005^{**}	5
	Large adults	115	13.0	13.0	15.7	27.8	27.0	3.5		
Winter	Young	21	19.0	57.1	14.3	9.5	0	0	7.7413^{ns}	3
	Small adults	48	52.1	39.6	6.3	2.1	0	0	1.4995^{ns}	3
	Large adults	27	63.0	25.9	7.4	3.7	0	0		

* Chi-square values are tests on the homogeneity of the distribution of observed fat levels in adjacent size groups
^{ns} = No significant difference
** = Difference significant at 99% level
† = Same test at 95% level

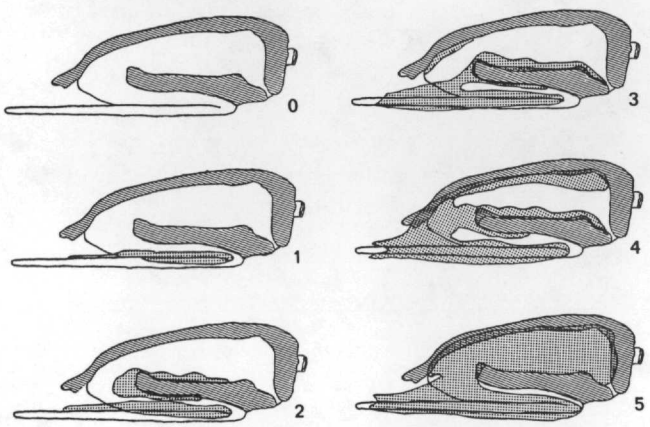

FIGURE 1. Level of fat deposition in *Ericymba*-ventral view. Numbers represent levels referred to in Table 1. Crosshatched area represents liver tissue; stippled area fat tissue; unshaded area the digestive tract.

TABLE 3

Change in levels of fat deposition in large adults (40.0+ mm standard length) from May to September.

Month*	N	Percentage of Individuals With Designated Fat Level					
		0	1	2	3	4	5
May	103	66.0	27.2	5.8	1.0	0	0
June	58	46.6	31.0	15.5	5.2	1.7	0
July	103	45.6	20.4	14.6	14.6	4.9	0
September	94	8.5	9.6	17.0	29.8	30.9	4.3

*August not included because low number of specimens precluded analysis

——— 1972 The ecology of the silverjaw minnow, *Ericymba buccata* Cope. Amer. Midl. Nat. 87: 172-190.
——— 1973a The reproduction of the silverjaw minnow, *Ericymba buccata* Cope. Trans. Amer. Fish. Soc. 102: 786-793.
——— 1973b The distribution and dispersal of the silverjaw minnow, *Ericymba buccata* Cope. Amer. Midl. Nat. 89: 145-155.
——— 1976 Feeding behavior and developmental, seasonal and diel changes in the food of the silverjaw minnow, *Ericymba buccata* Cope. Amer. Midl. Nat. 95: 361-376.